Headwaters of the South Fork Trinity Restoration Project

Hydrology Report

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For:
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Shasta-Trinity National Forest

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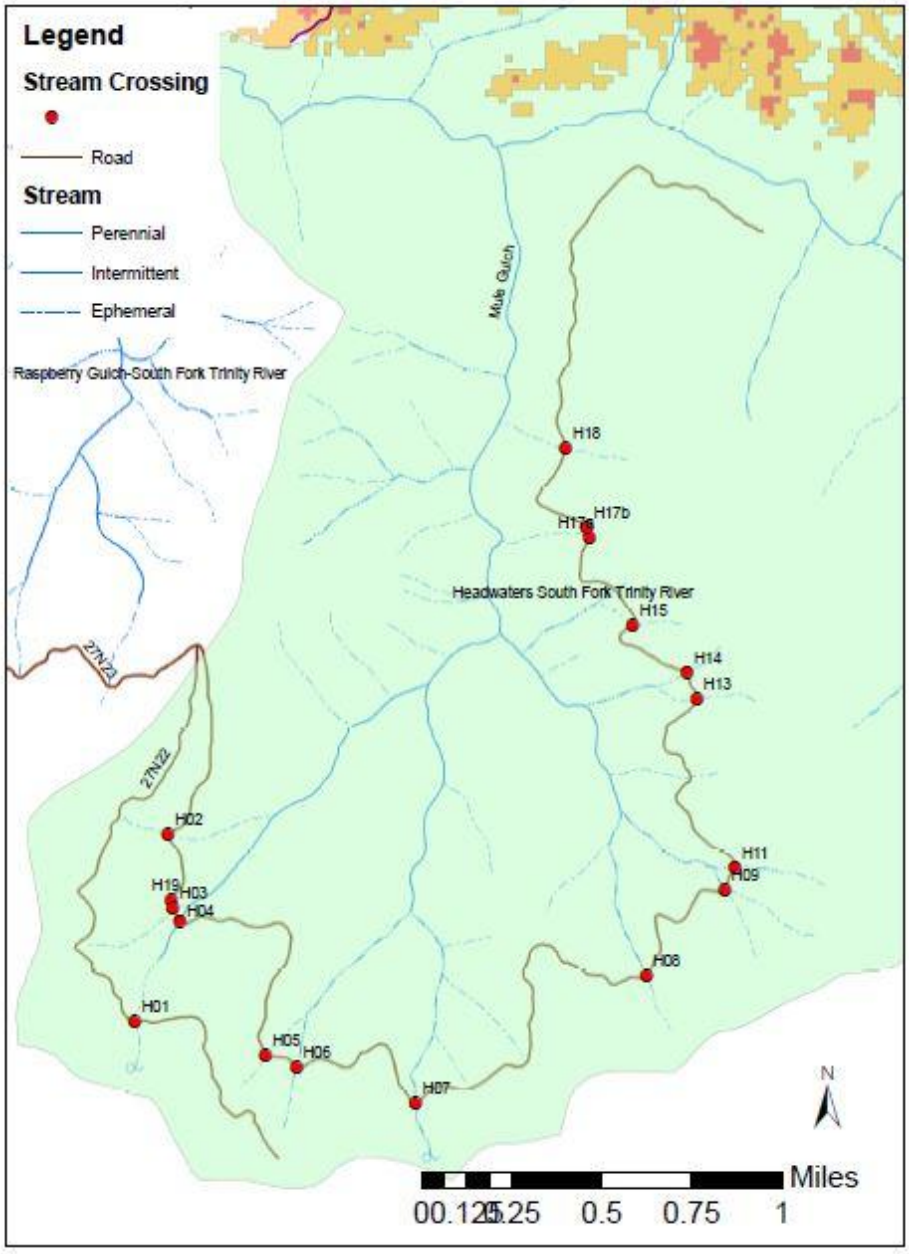
Introduction

This analysis focuses on the potential sediment discharges of the activities proposed in this project. This project intends to restore the hydrologic function and remediate the effects of roads and insufficiently designed and constructed stream crossings on roads in the Headwaters - South Fork Trinity Drainage.

The proposed activities are designed to remediate 17 stream crossings identified as legacy sediment sites in this drainage as shown in Figure 1. This analysis investigates the current condition and the appropriateness of the proposed action; and whether it will attain the desired outcome and comply with current directives. The ultimate goal of this project is to have this drainage delisted as sediment impaired as it is in the 2014 and 2016 California Integrated Report.

Figure 1. Headwaters South Fork Trinity River



Relevant Laws, Regulations, and Policy

Regulatory Framework

Land and Resource Management Plan

The Shasta-Trinity National Forest Land and Resource Management Plan (LRMP) provides the following standards and guidelines relevant to this project.

Water (LRMP, page 4-25):

- Analyze each land disturbing project for its effect on the appropriate 2nd or 3rd order watershed[1] to prevent excessive cumulative impacts on stream channel condition and water quality.
- Implement Best Management Practices (BMPs) for protection or improvement of water quality as described in "Water Quality Management for National Forest System Lands in California[2]," for applicable management activities. Determine specific practices or techniques during project level planning using information obtained from on-site soil, water, and geology investigations.
- Identify and treat areas with a degraded watershed condition in a cost-effective manner and according to beneficial use priorities. High priority items include domestic use, anadromous fish habitat, and sensitive species habitat. Improvement activities will be designed to meet Management Area objectives.
- Assess the potential impacts of road construction on slope stability and watershed condition for areas identified as moderately or highly unstable.
- When watering roads for dust abatement, follow the following rules:
  - Allow drafting from fishery streams only where immediate downstream discharge is maintained at 1.5 cubic feet per second or higher.
  - Never allow drafting to remove more than 50 percent of any stream discharge or 75 percent of constructed pond water.

- Roads Management in Riparian Reserves (LRMP, pages 4-54 and 4-55).
  - Prepare road design criteria, elements, and standards that govern reconstruction.
  - Minimize disruption of natural hydrologic flow paths, including diversion of streamflow and interception of surface and subsurface flow.
  - Restrict sidecast as necessary to prevent the introduction of sediment to streams.
  - Reconstruct roads and associated drainage features that pose a substantial risk.

[1] The average size of a 2nd or 3rd order watershed is about 1,000 acres. The smallest hydrologic unit delineated by the Shasta-Trinity National Forest is the 8th field sub-drainage (average size about 1,900 acres).
[2] National BMPs (USDA Forest Service, 2012) have replaced the Regional BMPs referenced in the LRMP.

    - Prioritize reconstruction based on current and potential impact to riparian resources and the ecological value of the riparian resources affected.

    - Stream crossings determined to pose a substantial risk to riparian conditions will be improved, to accommodate at least the 100-year flood, including associated bedload and debris. Priority for upgrading will be based on the potential impact and the ecological values of the riparian resources affected. Crossings will be constructed and maintained to prevent diversion of streamflow out of the channel and down the road in the event of crossing failure.

    - Minimize sediment delivery to streams from roads. Route road drainage away from potentially unstable channels, fills, and hillslopes.

- Key Watersheds (LRMP, page 4-59).

    - Key watersheds are highest priority for watershed restoration.

Desired Condition

The desired future condition of the Forests are broken out into specific resource goals as part of the Forest Goals (LRMP, page 4-4):

- Riparian Areas (LRMP, page 4-5).

    - Maintain or improve riparian habitat.

- Water (LRMP, page 4-6).

    - Maintain or improve water quality and quantity to meet fish habitat requirements and domestic use needs.

    - Maintain water quality to meet or exceed applicable standards and regulations.

Management Area

This project is located entirely within the South Fork Mountain Management Area (MA). Supplemental management direction for this MA relative to this project includes (LRMP, page 4-164):

- Maintain or improve habitat for steelhead and salmon with emphasis on spawning, rearing, and streamside cover areas.

- Recognize the potential for mass wasting and severe watershed damage when implementing land management activities.

- Maintain or enhance the water quality of tributaries of the South Fork Trinity River.

Riparian Reserves and Key Watersheds

The Aquatic Conservation Strategy (ACS) objectives (LRMP, page 4-53) provide direction for management of Riparian Reserves. Objectives specifically related to water resources include:

- Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

- Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

- Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.

- Maintain and restore instream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.

- Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

This project occurs in the Upper South Fork Trinity River Key Watershed. Key watersheds are important sources of high quality water (LRMP, page 4-59).

Federal Law

Clean Water Act

The objective of the Clean Water Act (CWA) is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. Basic requirements for compliance with the law include the following:

- Implement BMPs to reduce the level of nonpoint source pollution to the maximum extent possible and to improve water quality.

- States will identify impaired waterbodies and establish the total maximum daily load for those pollutants at a level necessary to implement applicable water quality standards.

Executive Orders

Protection of Wetlands, Executive Order No. 11990, 1977

The Forest Service is to minimize the destruction, loss, or degradation of wetlands, and preserve and enhance the natural and beneficial values of wetlands.

Floodplain Management, Executive Order No. 11988

The Forest Service is to avoid to the extent possible the long and short-term adverse impacts associated with the modification of floodplains.

State Law

Porter-Cologne Water Quality Control Act

The Porter-Cologne Act requires the North Coast Regional Water Quality Control Board to formulate and adopt a water quality control plan (Basin Plan) that conforms to the policies in this act.

Other Guidance

Forest Service Manual Chapter 2530

Water resource management policy includes the following:

- Promote and apply approved BMPs to all management activities as the method for control of non-point sources of water pollution, and for compliance with established state or national water quality goals.
- Include a water quality evaluation for all environmental analyses. Identify the water quality implications of proposed and alternative land management practices.

Forest Service Region 5 FSH 2509.22 – Soil and Water Conservation Handbook, Chapter 10 – Water Quality Management Handbook[3]

This handbook augments guidance for protection and improvement of water quality on National Forest Service lands, including:

- The objective to augment National BMP guidance to maintain water quality and beneficial uses consistent with State and Federal policies.
- The policy to implement BMPs during all current management activities on all NFS lands in California.
- BMPs are the practices that both the Federal and State water-quality regulatory agencies expect the Forest Service to implement to meet its obligation for complying with applicable water quality laws and standards, and to maintain and improve soil, and water quality, and riparian resources (to the extent that they contribute to maintenance of chemical, physical, and biological water quality). BMPs address protection of water quality from new and ongoing activities. Restoration of water-quality by correcting problems caused by past land uses (legacy sites) is also an important component of this plan.

Forest Service Region 5 FSH 2509.22 – Soil and Water Conservation Handbook, Chapter 20 – Cumulative Off-site Watershed Effects Analysis

Direction includes the following:

- Assess and evaluate cumulative watershed effects (CWE) of proposed activities. The Forest Service Pacific Southwest Region Cumulative Watershed Effects policy uses the equivalent roaded area (ERA) model to make a preliminary assessment of watershed conditions by comparing effects of past, existing, and reasonably foreseeable actions to a watershed threshold of concern. The assessment of potential CWE is included in NEPA analyses and can guide selection of alternatives by decision makers.

Water Quality Control Plan for the North Coast Region

Pertinent objectives for surface waters include:

- Waters shall not contain substances in concentrations that result in deposition of material that causes nuisance or adversely affect beneficial uses.

[3] Chapter 10 of the Region 5 Soil and Water Conservation Handbook (Amendment No. 2509.22-2011-1) expired in 2016. Its replacement has not yet been approved, but is available in draft form.

- The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.

- Turbidity shall not be increased more than 20 percent above naturally occurring background levels.

- The natural receiving water temperature of intrastate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Water Board that such alteration in temperature does not adversely affect beneficial uses.

- At no time or place shall the temperature of any cold water be increased by more than 5 °F (~3 °C) above natural receiving water temperatures.

North Coast Regional Water Quality Control Board Waiver of Waste Discharge Requirements

All activities managed by the Forest Service are to be conducted in compliance with the *Wavier of Waste Discharge Requirements for Nonpoint Source Discharges Related to Certain Federal Land Management Activities on National Forest System Lands in the North Coast Region* (Waiver). The Waiver (Cal. EPA, Regional Water Board. 2015) is the implementation mechanism to address impaired watersheds. Several general conditions of the Waiver that are relevant to this project include:

- The Forest Service shall facilitate early Regional Water Board staff involvement in the project planning process for all projects that have a potential to impact water quality and for projects that will be covered by this Waiver. This includes project scoping, NEPA development and review, and pre- project consultations.

- The Forest Service shall manage and maintain designated riparian zones to ensure retention of adequate vegetative cover that results in natural shade conditions, within 300 feet slope distance on each side of fish- bearing streams, 150 feet slope distance on each side of perennial streams, and 100 feet slope distance on each side of intermittent streams, or the site potential tree height distance on each side of the stream, whichever is greatest. Exceptions to this condition will be considered.

- Compliance with all of the conditions of the Waiver constitutes compliance with sediment and temperature TMDL implementation. TMDL implementation includes: legacy sediment site inventories, prioritization, and treatment; retention of natural shade within designated riparian zones; and application of on-the-ground prescriptions that meet Forest Service BMPs for new activities.

- Activities conducted under this Waiver must be in compliance with water quality requirements, the Basin Plan, and amendments thereto.

- The discharge of soil, silt, bark, slash, sawdust, or other organic and earthen material from any logging, construction, or associated activity of whatever nature into any stream or watercourse in quantities deleterious to fish, wildlife, or other beneficial uses is prohibited.

The Waiver categorizes activities as Category A or Category B. Category A activities have a low potential impact to water quality. Activities with a moderate potential impact to water quality are Category B. Category B conditions include:

- The Forest Service shall actively address all legacy sediment sites within the project area. Legacy sediment sites must be identified, inventoried, prioritized, scheduled, and implemented for treatment. The inventory shall be submitted to the Regional Water Board during project

development. Successful implementation of treatments is required for Sediment TMDL compliance.

- The Forest Service shall submit a complete Waiver application.
- Activities shall be monitored to assure that prescribed BMPs are implemented and effective in avoiding any adverse impacts to water quality.

South Fork Trinity River and Hayfork Creek Sediment Total Maximum Daily Loads

Roads are the biggest source of controllable sediment delivery in the basin. Many existing and potential road sediment deliveries can be corrected relatively easily, resulting in both decreased sediment delivery and, in many cases, lower road maintenance costs (U.S. EPA, 1998). The ultimate success of the TMDL include meeting targets for select indicators that include:

- Stream crossings with diversion potential – less than 1%.
- Stream crossings with significant crossing failure potential[4] – less than 1%.
- Hydrologic connectivity – reduced to the extent feasible.

Regional Water Board Temperature Guidance[5]

Natural receiving water temperatures are the temperatures that occur when the factors controlling water temperature, including shade, flow, and channel morphology, are equivalent to their natural condition. In assessing natural temperatures, anthropogenic factors that may cumulatively act on a stream to alter its temperatures must be considered, including:

- Upstream flow alterations;
- Past canopy removal, either mechanically or as a result of increased sediment loads; and,
- Alteration of channel characteristics such as width, depth, and streambed permeability associated with geomorphic changes caused by altered sediment loads.

When stream temperatures have been altered in the past, the degree of temperature alteration must be evaluated to determine:

- Whether the existing temperatures meet the intrastate water quality objective for temperature;
- What beneficial uses may have been supported prior to alteration of the temperature; and,
- How much temperature increase can occur without exceeding the intrastate water quality objective for temperature.

Estimates of natural temperatures can be developed by comparison with reference streams.

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[4] Culverts and crossings should be designed to pass the 100-year flood, including snowmelt, and associated debris and sediment, targeting crossings with the highest probability of failure and highest consequences.

[5] A temperature TMDL for the South Fork Trinity River sub-basin is not available, but the Regional Water Board has provided temperature guidance in *Staff Report Supporting the Policy for the Implementation of the Water Quality Objectives for Temperature and Action Plan to Address Temperature Impairment in the Mattole River Watershed, Action Plan to Address Temperature Impairment in the Navarro River Watershed, and Action Plan to Address Temperature Impairment in the Eel River Watershed* (2014).

Pacific Coast Federation of fishermen's Associations v. National Marine Fisheries Service, 265 F.3d 1028 (9th Cir. 2001)

The United States Court of Appeals for the Ninth Circuit ruled that because the evaluation of a project's consistency with the long-term, watershed level ACS objectives could overlook short-term, site-scale effects that could have serious consequences to a listed species, these short-term, site-scale effects must be considered.Topics and Issues Addressed in This Analysis

Purpose and Need

Hydrologic resources are driving the Purpose and Need for Action of this project. The South Fork Trinity River watershed is impacted by excessive sediment. By upgrading these stream crossings in the project area to crossings designed to pass the 100-year storm flow plus bedload and debris, the sedimentation potential of the roads in this drainage will be reduced to the minimum risk and there will be no other actions to take for restoration while the roads still exist.

Issues

Issues identified through scoping in which water resources are directly related include:

- Cumulative impacts should be looked at, including wildfires, prescribed burns, and timber projects.
- Water quality standards are not met in the watershed.
- Upper South Fork Trinity River is a Key Watershed.
- Aquatic Conservation Strategy objectives must be met.

Resource Indicators and Measures

The resource indicator used to quantify the effects of activities is sediment or sediment potential represented by Equivalent Roaded Area (ERA) and temperature (Table 1).

Table 1. Water resources indicator and measure for assessing effects.

Resource Element	Resource Indicator	Measure	Used to address: P&N, or key issue?	Source
Water quality	Sediment	Equivalent Roaded Area (acres)	Yes	R5 FSH 2509.22 Chapter 20

Methodology

A water quality evaluation identifies: (1) designated beneficial uses of the watersheds, (2) pollutants in the watersheds, (3) sources of the pollutants, and (4) causes of the pollutants.

The potential for cumulative watershed effects of proposed activities are assessed using the equivalent roaded area model developed by Haskins (1983) to estimate the ERA within each hydrologic unit (HUC[6] 5 to 8). The results are compared against the ERA of the established threshold of concern[7] (TOC). All past, present, and reasonably foreseeable actions within the affected hydrologic units that can be accounted for are modeled. ERA disturbance factors used by the Shasta-Trinity National Forest were developed using the coefficients described by Haskins (1986), surrounding forests, scientific literature, and professional judgment. Disturbance factors for each type of activity are described by an equation of the form:

where y is the disturbance factor, *a* is a disturbance constant, b is a recovery coefficient, and x is duration in years. The disturbance factor y is multiplied by the activity area in acres to calculate the ERA for the assessment year.

BMPs are selected from the Forest Service National BMPs (USDA, Forest Service, 2012) to control nonpoint source pollution related to management actions with the potential to affect water quality.

Information Sources

High water temperatures could result from natural conditions[8], water diversions, loss of riparian vegetation, and excess sedimentation that results in channel widening and decreased water depth.

Stream water temperatures increase due to more solar radiation reaching the stream surface when riparian shade is lost. The annual maximum stream temperature increased from 57 °F to 85 °F one year after clear-cut logging on a small watershed in Oregon's coast range. Summer maximum temperatures approached pre-logging levels within about six years after logging was completed as riparian vegetation became reestablished (Brown and Krygier, 1970).

Reference sites are locations that function as examples of undisturbed or minimally- disturbed conditions, and display an absence of significant anthropogenic disturbance or alteration (NCRWQCB, 2015b).

Reference sites in the South Fork Trinity River sub-basin include Powell and Potato Creek. Powell is located on the South Fork Trinity River in the Yolla Bolly-Middle Eel Wilderness. Potato Creek is a tributary of East Fork Hayfork Creek and is located about one mile downstream from the Chanchelulla Wilderness.

Incomplete and Unavailable Information

Natural receiving water temperatures of Mule Gulch is unknown. There is no temperature or sediment data available for Mule Gulch.

[6] The hydrologic unit code (HUC) uniquely identifies each hydrologic unit. The number associated with the HUC relates to watershed size—higher numbers refer to smaller watersheds. Each hydrologic scale is represented by two numbers. A HUC 5 is a ten digit code, a HUC 7 is a 14 digit code, etc.

[7] TOC is a management level threshold of a watershed, where if exceeded, the risk of cumulative effects increase dramatically. TOC was established in the LRMP Final EIS only for HUC5s and HUC6s. Therefore, for HUC7s and HUC8s, the HUC6 TOC has been used to establish the TOC.

[8] Water temperatures in the lower South Fork have always been relatively warm in the summer, even prior to active land management in the sub-basin.

Spatial and Temporal Context for Effects Analysis

The spatial area for water resources where effects may be caused are the hydrologic units (fifth field through eighth field) in which project activities will occur.

The hydrology analysis extends for five years and assumes the project will be completed in one year. Time reduces the potential for indirect effects and effects are often not evident within about five years of project implementation. Also, there are no foreseeable future projects beyond 2025.

Affected Environment

Existing Condition

Designated beneficial uses of waterbodies in the project area include: municipal and domestic; agricultural and industrial supply; groundwater recharge and freshwater replenishment; navigation; water contact recreation, and non-contact water recreation; commercial and sport fishing; cold freshwater habitat; wildlife habitat; rare, threatened, or endangered species; migration of aquatic organisms; and spawning, reproduction, and/or early development. Hydropower generation, and aquaculture are potential future beneficial uses (Cal. EPA, Regional Water Board, 2011).

Pollutants in the project area include sediment and temperature (Cal. EPA, Regional Water Board, 2017). The migration, spawning, reproduction, and early development of cold water fish are impacted by increased stream temperatures and accelerated sedimentation rates. The impairment has resulted in non-attainment of designated beneficial uses – specifically commercial and sport fishing; cold freshwater habitat; rare, threatened, and endangered species; migration of aquatic organisms; and spawning, reproduction, and/or early development.

Sources of the increased sediment rate are primarily from roads (U.S. EPA, 1998). Undersized culverts that aren't designed to pass 100-year flood peak flows and debris, stream crossings with diversion potential, and roads that aren't hydrologically disconnected from streams are primary causes of road produced sediment.

The current condition of the two roads is the primary contributor to the sediment impairment of the Headwaters – South Fork Trinity Drainage. As recently as the 1970s, stream crossings on low volume forest roads were designed based on subjective methods by the crews performing the work. It was standard practice to reconstruct failed crossings to the same standards as the original facility (Weaver, et al., 2015). Current standards for stream crossing design and reconstruction require them to be designed and built to pass the 100 year storm flow plus bedload and debris (LRMP, 1995). The roads in the project area were constructed prior to the 1970s and several crossing failures have occurred and repairs were only done to make the road passable again, erosion is ongoing, and a high risk of sedimentation still exists.

Sediment and ERA

Past disturbances in the project area watershed included in modeling: timber harvests, grazing, road construction, the Trough and Buck Fires, and fuels treatments. Present and future foreseeable actions and projects that are modeled include: the pile burning of slash generated during the Buck Fire and the road work proposed in this project.

The current equivalent roaded area caused from all past actions is shown in Table 2 for each of the hydrologic units in the project area. No hydrologic units are over the threshold of concern.

Table 2. Existing condition ERA for the hydrologic units in the project area (2019).

Hydrologic Unit	ERA (Acres)	Risk Ratio (%	Disturbance

5	6	7	8		of TOC)	Level
Upper South Fork Trinity River				1886	13	low
	Shell Mountain			376	10	low
		Headwaters South Fork Trinity River		98	7	low
			1801021201010104	30	8	low
			1801021201010105	13	6	low

Environmental Consequences

Proposed Action

The proposed action is designed to upgrade stream crossings with a significant risk of sediment discharge in the Headwaters of the South Fork Trinity River. Because this area is remote, there is minimal opportunity for regular road maintenance and good crossing design is essential to minimize sedimentation and ensure the road resists wet weather and storm flows. Table 3 summarizes the effect of upgrading the crossings as recommended in the Legacy Sediment Site report. If the crossings are not upgraded, more crossings will fail and deliver sediment to streams, degrade water quality, harm aquatic habitat, and make the roads impassable.

Table 3. Water resources indicator and measure for the Proposed Action.

Resource Element	Resource Indicator (Quantify if possible)	Measure (Quantify if possible)	Proposed Action
Water quality	Sediment	Equivalent Roaded Area (acres)	Net positive result as improved crossings reduce sediment delivery potential to minimum with current roads in the watershed

Project Design Features and Mitigation Measures

BMPs

Activities for which BMPs are required for this project are road management activities. The Stream Crossing Upgrade Guide for NEPA Projects on the West Side of the Shasta-Trinity National Forest lists BMPs for planning and implementing road maintenance and reconstruction activities in streams and Riparian Reserves. These BMPs are taken from the Forest Service national BMPs technical guide (USDA Forest Service, 2012).

Water Drafting

Control actions designed to protect water quantity and aquatic habitat include the following:

Water drafting from fish-bearings streams is allowed only where immediate downstream discharge is maintained at 1.5 cubic feet per second or greater.

Water drafting shall never remove more than 50 percent of any stream discharge or 75 percent of constructed pond water.

Required Monitoring

Implementation and effectiveness monitoring are required for road projects to comply with the Waiver. This is primarily accomplished with the BMP inspection and evaluation process. The following BMP protocols are appropriate for this project.

- Roads A -- Active Road and/or Waterbody Crossing Construction or Reconstruction. The implementation and effectiveness inspections are accomplished during construction and focus on the crossing and the road approaches.

- Roads B – Completed Road and/or Waterbody Crossing Construction or Reconstruction. The implementation inspections in this protocol should occur as soon as possible after completion of work and the effectiveness is evaluated after a winter season. The locations to be inspected/evaluated are the same as the Roads A protocol.

The Waiver also requires storm patrol monitoring. The Roads B effectiveness monitoring can be accomplished at the same time as access to the project area is typically after the wet season is over.

Because this project is designed to abate sediment discharge, the TMDL requires tracking of the project for inclusion in annual reporting.

Additionally, in order to get the South Fork Trinity River (SFTR) watershed delisted as sediment impaired, the EPA has set sediment indicators and targets in the TMDL that need to be shown to improve or meet target values as shown in Table 4 as follows. The best location to measure these indicators to verify project success is immediately upstream of the SFTR on Mule Gulch, Figure 1.

Table 4. Water resource indicators and measurements for project monitoring.

Resource Indicator	Measure	Target Level	Explanation
Embeddedness	Percent cobbles are buried by fine sediments at pool tail-outs	$\leq$ 25% or improving (decreasing) trend	Indication of good salmonid spawning substrate
Substrate Size Distribution	Percent Fine Sediment $\leq$ 0.85 mm	$\leq$ 14%	Relates to salmonid reproduction success
Tributary Residual Pool Volume (V*)	Fraction of a pool's volume filled with fine sediment	Mean $\leq$ 0.21	Provides a measure of the in-channel supply of mobile bedload sediment
Stream Temperature	Mean maximum temperature for the period July 1 – August 31	Decreasing trend (no TMDL target)	Temperature impacts health, behavior and survival of aquatic organisms
Stream Shade	Average canopy cover	Increasing	Shade influences water temperature and health of aquatic organisms
Large Woody Debris	Tally of pieces of large woody debris	Increasing distribution, volume & of key pieces	Estimates improving habitat availability
Macroinvertebrates	Samples are evaluated for: Ephemoroptera, Plecoptera, and Tricoptera Index; Percent Dominant Taxa; and Richness Index	Improving trends (greater diversity and productivity)	Estimates salmonid food availability, indirect estimate of sediment and water quality

Direct and Indirect Effects

This project will have a minor direct effect on sediment delivery, but it is not likely to affect temperature. Project BMPs will reduce sediment delivery during crossing reconstruction to negligible levels. This effect will be temporary as the project area adjusts to the new crossings. Riparian shade will be reduced slightly within the construction footprint. Most of the trees and brush that will be removed will be from the fillslopes at the crossings. The stream water is shaded simply by flowing through the culvert at crossings and very little of the vegetation that shades the water as it either enters or exits the culvert will be disturbed. It is predicted that there will be favorable indirect effects as the sediment delivered to the streams declines due to the improved stream crossings and hydraulic disconnection of the road surface at the crossings. In Table 5, the model results show no increase in ERA due to the project activity in the year of implementation. The beneficial effect of the stream crossing upgrades is maximized the first year and continues to improve the ERA (reduce) in following years, a little less each year. The ERA improvement will continue for approximately 50 years.

Sediment

Table 5. Resource indicators and measures for direct/indirect effects, 0/1/3/5 years after completion.

Hydrologic Unit				ERA (Acres)	ERA (Acres)	ERA (Acres)	ERA (Acres)
5	6	7	8	0 yr	1 yr	3 yr	5 yr
Upper South Fork Trinity River				0	-24.8	-17.9	-14.7
	Shell Mountain			0	-24.8	-17.9	-14.7
		Headwaters South Fork Trinity River		0	-24.8	-17.9	-14.7
			1801021201010104	0	-24.0	-17.3	-14.2
			1801021201010105	0	-0.8	-0.6	-0.5

Cumulative Effects

Past, Present, and Reasonably Foreseeable Activities Relevant to Cumulative Effects Analysis

Past activities relevant to this project area include road construction, the Trough and Buck Fires, grazing, and logging activities. At the present time, slash piles from fire lines on the Buck Fire are being treated. After this project, there are not foreseeable activities, however grazing is likely, but impacts are relatively minor as a stand-alone activity.

Sediment

The largest contributor of sediment in the affected hydrologic units is from road construction in the 1960s. The cumulative effects of unspecified activities in the past are another large contributor to the ERA, but only about half as much as the road construction. The Buck Fire dozer lines and high burn severity areas are significant contributors in the recent past. The positive effects of the road upgrades begin to decline after the first year as seen in Table 6 in the smaller hydrologic units, but the ERA due to road construction is constant unless roads or portions of road are hydrologically closed.

Table 6. Resource indicators and measures for Proposed Action cumulative effects, 1/3/5 years.

Hydrologic Unit				ERA (Acres)			Risk Ratio (% of TOC)			Disturbance Level		
5	6	7	8	1 yr	3 yr	5 yr	1 yr	3 yr	5 yr	1 yr	3 yr	5 yr
Upper South Fork Trinity River				1790	1747	1710	13	12	12	low		
	Shell Mountain			345	346	344	9	9	9	low		
		Headwaters South Fork Trinity River		72	79	81	5	5	6	low		
			1801021201010104	6	12	15	2	3	4	low		

			1801021201010105	12	12	12	9	6	6	low

Summary

Degree to Which the Purpose and Need for Action is Met

Water quality is the primary concern of this project. Sediment is the primary pollutant in the Headwaters South Fork Trinity River. This project will improve the hydrologic function of 17 stream crossings and minimize sediment delivery from the road to the watercourses. Short of hydrologic closure of the roads, this is the best way to reduce sediment delivery potential from a road surface. Upgrading these 17 road stream crossings will be a test bed for watershed restoration activities.

Degree to Which the Proposed Action Addresses the Issues

The proposed action is wholly designed to reduce sediment delivery to streams from the roads in the project area. Table 7 lists the issues and how the proposed action will address those issues. This project intends to remediate the effects of all the identified road stream crossings that have sediment potential in the Headwaters of the South Fork Trinity River.

Table 7. Summary of how the Proposed Action addresses the key issues.

Issue	Indicator/Measure	Proposed Action
Road stream crossings with undersized culverts or inadequate structures impact water quality by increasing sedimentation	Number of road stream crossings with undersized culverts	Upgrades 17 stream crossings to pass the 100yr storm flow plus bedload and debris
Diversion potential at road stream crossings due to lack of critical dip and/or rolling dip	Critical dip and/or rolling dip as a design feature of a road stream crossing	Installs critical dips at 7 crossings and 4 rolling dips near crossings to hydrologically disconnect the road from the streams

Summary of Environmental Effects

This project is reasonably sized, the improvements are measureable, and serves to prove the concept that watershed restoration is not only desirable, but attainable. Implementation of this project may take a decade as funding becomes available. Instream monitoring has been accomplished at a reference site nearby, Powell, to establish attainable conditions. Instream monitoring to measure the indicators targeted by the TMDL listed in Table 4 in Mule Gulch will be required after project completion to verify the effectiveness of the treatments.

The summary of environmental effects is listed in Table 8 as follows.

Table 8. Summary of environmental effects to water resources.

Resource Element	Indicator/Measure	Proposed Action
Water quality	Sediment delivery potential (represented as ERA)	17 crossings would be improved to meet current design standards, reducing sediment delivery potential and resultant impacts to water quality
Riparian Function, and Channel Stability	Undersized culverts at stream crossings	17 upgraded road stream crossings will restore channel stability by reducing erosion and will stabilize the channel up and downstream of the crossing

Extraordinary Circumstances

The resource conditions of floodplains, wetlands, and municipal watersheds were considered for whether or not protection measures are necessary and whether further analysis is needed.

The wetlands mapped on the National Wetlands Inventory Wetland Mapper are the stream beds and out to the extent of the riparian vegetation. This project will disturb soil in the immediate vicinity of the crossings being upgraded. BMPs will be implemented to minimize the delivery of sediment to the water courses and a minimum amount of small trees and vegetation will have to be removed to facilitate the work. This project will have a negligible immediate effect on the wetlands and this will quickly recover and improve the condition of the streams and wetlands as erosion is minimized, less sediment enters the streams, and catastrophic crossing failure potential is mostly eliminated.

The floodplains in the project area are relatively narrow due to the steep terrain and extend up the walls to the level of the 100 year flows. Like wetlands, the floodplains will be minimally affected and will recover to better than pre-project condition.

Municipal water supply is a beneficial use of water in this area. Work will be done most likely at low or no flow conditions and BMPs will be implemented to minimize sediment delivery. Any effect on the water quality standards of this beneficial use will be immeasurable.

The mere presence of these resource conditions does not preclude the use of a categorical exclusion as there is negligible potential effect on these resource conditions that may result from the proposed action. The proposed action is designed to have a positive effect on sediment delivery potential to the watercourses and, thus, a negligible effect on these resource conditions. There are no extraordinary circumstances that require further analysis.

Compliance with LRMP and Other Relevant Laws, Regulations, Policies and Plans

Implementation of the proposed action is direct compliance with the Forest Plan, the Soil and Water Conservation Handbook, the Waiver, and the Aquatic Conservation Strategy objectives.

The Forest Plan:

- Cumulative effects have been analyzed at the HUC5-8 levels.
- BMPs are prescribed and will be implemented.
- Project activities are designed to treat sediment sources on are roads.
- Stream crossings are being upgraded to pass the 100-year flood plus bedload and debris.
- Water drafting standards will be implemented.
- This is a watershed restoration project in a Key Watershed.
- Water quality will be improved by this project.

Soil and Water Conservation Handbook:

- BMPs are prescribed and will be inspected and evaluated.

- Cumulative effects have been analyzed, negative effects are negligible and watershed conditions will be improved.

Maintain and restore ACS objectives:

- The physical integrity of the aquatic system will be maintained and restored by the stream crossing upgrades by improving hydrologic function and minimizing sediment delivery.
- Water quality will be restored by minimizing sediment delivery from the roads in the project area.
- The sediment regime will be restored by improving the water crossings to current design standards making room for a 100-year flood flow plus bedload and debris.
- Instream flows will be maintained and restored by improving the crossings, reducing ponding at the crossing inlets, reducing infiltration and maximizing stream flow.
- Floodplain inundation will be restored by improved crossing design that will allow the water to flow through the crossing structures unimpeded.
- Achievement of other ACS objectives will not be prevented.

The Waiver:

- The Regional Water Board was involved early in the planning process.
- BMPs are prescribed in the Shasta-Trinity Stream Crossing Upgrade Guide.
- Legacy sediment source sites are being addressed by this project.
- Beneficial uses are protected.

The TMDL:

- Compliance with the Waiver constitutes compliance with the TMDL.

Once all these legacy sites are improved, this drainage will be restored since all the man-made issues will have been addressed and there will be no more improvements to be made. The sediment delivery potential at that point will be as close to the natural condition as possible.

Other Agencies and Individuals Consulted

North Coast Regional Water Quality Control Board
August 24, 2018. The Water Board received the scoping letter from the Forest Service.
August 30, 2018. Field trip with Maggie Robinson, Galen Anderson, and David Schmerge. The most problematic stream crossings of the project were visited. Maggie Robinson suggested that the best way to repair the failed crossing H19 was a rocked dip with an armored outlet since the inlet basin was too small and shallow to allow installation of an appropriately sized culvert. Therefore, the original repair calling for a 60” culvert has been changed to reflect her recommendation. Similarly, the recommended upgrades for H1, H13, and H14 were modified to work best within the existing road prism and various stream channel shapes and sizes.
February 5, 2019. Sent another request for Water Board feedback on project Waiver category. No response.

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